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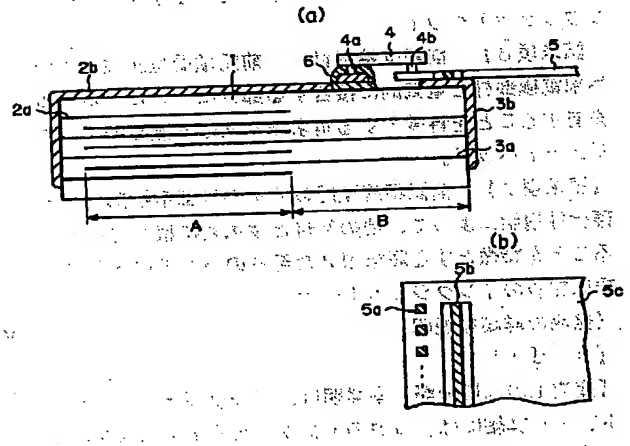
(54)【発明の名称】　インクジェットヘッド

(57)【要約】
【目的】　所定ピッチで分断した圧電素子を使ったアクチュエータを有するインクジェットヘッドにおいて、各分断された圧電素子との電圧的接続等を簡単かつ確実に行えるようにし、生産性等を向上させる。
【構成】　駆動ＩＣ４をアクチュエータの非実行部Ｂ上で駆動ＩＣ４の出力信号端子４ａは、前後複数ｃｈのアクチュエータと同じピッチに配列され、各ＰＺＴ１の外部電極２ｂと光硬化性樹脂６で電気的に接合されている。



【特許請求の範囲】

【請求項１】　実行部と非実行部を有し、所定のピッチで１列に分断された複数の積層型圧電素子から成り、該積層型圧電素子の少なくとも一部に外部選択電極部材と外部共通電極部材が配置されたアクチュエータを有し、前記外部共通電極部材が前記積層型圧電素子の実行部から離れて配設されていることを特徴とするインクジェットヘッド。

【請求項２】　実行部と非実行部を有し、所定のピッチで１列に分断された複数の積層型圧電素子から成り、該積層型圧電素子の少なくとも一部に外部選択電極部材と外部共通電極部材が配置されたアクチュエータを有し、前記積層型圧電素子の非実行部上に前記積層型圧電素子を選択的に駆動させるための駆動ＩＣを有することを特徴とするインクジェットヘッド。

【請求項３】　実行部と非実行部を有し、所定のピッチで１列に分断された複数の積層型圧電素子から成り、該積層型圧電素子の少なくとも一部に外部選択電極部材と外部共通電極部材が配置されたアクチュエータを有し、前記積層型圧電素子を選択的に駆動させるための駆動ＩＣの少なくとも一部が、前記積層型圧電素子および補助部材上に配置されていることを特徴とするインクジェットヘッド。

【請求項４】　前記駆動ＩＣは少なくとも一部が支持部材に接合されていることを特徴とする請求項２記載のインクジェットヘッド。

【請求項５】　前記支持部材に電気回路がパターニングされ、前記駆動ＩＣは少なくともその一部が、前記支持部材を介して前記積層型圧電素子の外部電極部材と電気的に接合されていることを特徴とする請求項４記載のインクジェットヘッド。

【請求項６】　前記支持部材は、前記積層型圧電素子の外部電極部材と電気的に接合する部分に、スルーホールを有することを特徴とする請求項４又は５記載のインクジェットヘッド。

【請求項７】　前記積層型圧電素子の外部電極部材が光硬化性樹脂によって、他の部材と電気的に接合されていることを特徴とする請求項２乃至６のうちのいずれか１項に記載のインクジェットヘッド。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、インクジェットヘッド、より詳細には、多数のインクジェットノズルを有するいわゆるマルチノズル式のインクジェットヘッドに関する。

【０００２】

【従来の技術】図８は、従来のマルチノズル式のインクジェットヘッドの圧電素子電極と信号線電極の接合例（特開昭５５－８６７６５号公報）を示す図で、図中、２０は圧電素子２１の一方の側に配設された上部電極、２６は圧電素子２１の他方の側に配設された下部電極で、図示のように圧電素子２１の上下に電極２０，２６を設け、上部電極２０をハンダ付け部２２にて選択電極２３と接続し、下部電極２６を圧力室上に配設した振動板の共通電極２４に接合するようにしたものである。

【０００３】また、本出願人は、先に基板上に配置された電極パターンを各圧電素子のスリット加工と同時にパターン分離することによって、圧電素子から外部へ独立した電気的接続とするインクジェット記録装置について提案した（特開平３－７３３４７号公報）。

【０００４】図９及び図１０は、本出願人が先に提案したインクジェットヘッドの一例を説明するための斜視図、基板３０は通常シリコン、セラミック、ガラス、樹脂等よりなり、電極は、通常、圧電素子駆動ＩＣの電極接続用電極３１ａと、外部リード線接続用の電極３１ｂと、グランド電極用の電極３１ｃとから成り、これら電極が基板３０上にパターニングされている。このように、電極がパターニングされた基板３０上に、概略の位置決めによって圧電素子３２を、たとえば、接着等の手段により接合している。つぎに、この圧電素子３２にスリット３３の加工を、たとえば、切削加工等により行う。スリット３３の巾を３０～４０μｍ、圧電素子３２の巾を８０～９０μｍ程度で加工することにより８本／ｍｍ程度の集積化が可能となる。これは通常のダイシングソー等により十分加工可能である。

【０００５】図１１は、図１０のＡ－Ａ線断面図で、同図は、上述のごとくしてスリット３３を形成した後の図で、このスリット加工によって圧電素子３２が実質的に分離されるのと同時に電極パターンも分離・独立される。つまり、このとき圧電素子３２と同時に基板３０も一部加工することになる。また、基板３０の前面（図１１のＭ部）は、グランド電極３１ｃを分離しないようにするため加工をしないようにしている。このあとで、駆動ＩＣ３４（分離した電極のパターンのピッチに合わせて電極が配置されている）をチップフローなどによって取付ける。基板３０の材質を適当に選択することによって、駆動ＩＣ３４の放熱を十分に行うことも可能となる。

【０００６】

【発明が解決しようとする課題】しかし、図８に示した従来技術では、画像品質の向上あるいは印字スピードの高速化等でノズルの集積化が進み、圧電素子が増加された場合、ヘッド本体２５上に配設される選択電極２３の配置が複雑になり、工程に時間がかかり、電極間の距離も短かくなり、ショートする恐れもでてくる。

【０００７】また、図９乃至図１１に示した本出願人が先に提案した技術によると、電極間のショートは防止できるが、各圧電素子のグランド電極を分離しないように圧電素子の前面でスリット加工を中断し、共通電極としているため、スリット加工中に圧電素子が破損する恐れ

があり、歩留まりが悪い。

【０００８】本発明は、上述のごとき実情に鑑みてなされたもので、特に、高密度に集積されたアクチュエータから外部への電気的接続において、ショートを防止し、更には、加工性、組立性を向上させ、費用の低減を図ると共に信頼性を向上させたインクジェットヘッドを提供することを目的とする。

【０００９】

【課題を解決するための手段】本発明は、上記課題を解決するために、（１）実行部と非実行部を有し、所定のピッチで１列に分断された複数の積層型圧電素子から成り、該積層型圧電素子の少なくとも一部に外部選択電極部材と外部共通電極部材が配置されたアクチュエータを有し、前記外部共通電極部材が前記積層型圧電素子の実行部から離れて配設されていること、或いは、（２）実行部と非実行部を有し、所定のピッチで１列に分断された複数の積層型圧電素子から成り、該積層型圧電素子の少なくとも一部に外部選択電極部材と外部共通電極部材が配置されたアクチュエータを有し、前記積層型圧電素子の非実行部上に前記積層型圧電素子を選択的に駆動させるための駆動ＩＣを有すること、或いは、（３）実行部と非実行部を有し、所定のピッチで１列に分断された複数の積層型圧電素子から成り、該積層型圧電素子の少なくとも一部に外部選択電極部材と外部共通電極部材が配置されたアクチュエータを有し、前記積層型圧電素子を選択的に駆動させるための駆動ＩＣの少なくとも一部が、前記積層型圧電素子および補助部材上に配置されていること、更には、（４）前記駆動ＩＣは少なくとも一部が支持部材に接合されていること、更には、（５）前記支持部材に電気回路がパターニングされ、前記駆動ＩＣは少なくともその一部が、前記支持部材を介して前記積層型圧電素子の外部電極部材と電気的に接合されていること、更には、（６）前記支持部材は、前記積層型圧電素子の外部電極部材と電気的に接合する部分に、スルーホールを有すること、更には、（７）前記積層型圧電素子の外部電極部材が光硬化性樹脂によって、他の部材と電気的に接合されていることを特徴としたものである。

【００１０】

【作用】外部共通電極部材を積層型圧電素子の実行部から離して配置することで、外部共通電極部材での影響が実行部に及びにくくする。また、積層型圧電素子の非実行部の上に駆動ＩＣを配し、インクジェットをコンパクトにする。また、駆動ＩＣを支える補助部材を配置することで積層型圧電素子を小さくする。また、駆動ＩＣを支持部材に取り付けてから圧電素子上に接合するようにすることで、圧電素子上に接合する際の取扱いを楽にし、かつ、圧電素子と直接駆動ＩＣが接しないようにすることで、圧電素子の実行部からの振動を駆動ＩＣに伝えにくくする。更には、支持部材に電気回路をパターンクしておき、圧電素子と一括接合できるようにする。更には、支持部材にスルーホールを設けることで、支持部材の表裏間を電気的につなげるとともに、該スルーホールにはんだを逃がすようにする。更には、電極等の接合部に光硬化性樹脂を使うことで、熱による圧電素子の劣化を防止する。

【００１１】

【実施例】図１は、圧電材料と電極材料を交互に複数積層してなる積層型圧電素子１の断面を示す図で、以下、この積層型圧電素子（以下ＰＺＴ）１を所定ピッチで１列に全長にわたり分断し、配列したアクチュエータを形成した場合の電極の接合や取り出し法について説明する。

【００１２】図２は、ＰＺＴ１に外部選択電極２ｂ，外部共通電極３ｂを配列した場合の断面図で、同図において外部通電極３ｂは、内部選択電極２ａと内部共通電極３ａの重なっているＰＺＴ１の実行部Ａから離れて配置されている。なお、外部電極２ｂ，３ｂはＮｉ，ＡｇＰｄ，Ａｕ，半田等で形成され、ＰＺＴ１の両面にて、各内部電極２ａ，３ａと電気的に導通されている。

【００１３】次に、所定のピッチでダイシングソー等によりＰＺＴ１を外部電極２ｂ，３ｂごと溝加工を施し、複数Ｃｈ（チャンネル）を有するアクチェータを形成する。この際、外部共通電極３ｂは外部選択電極２ｂと同様に溝加工によって各Ｃｈで分断されているので、電気的に導通をとる必要がある。前述の図２の説明のように、外部共通電極３ｂが、ＰＺＴ１の実行部Ａから十分に離れていれば、外部共通電極３ｂの導通を取るための導電性部材（半田、銀ペースト等）が内部電極内に入り込んでも内部選択電極２ａとショートする心配がない。

【００１４】図３（ａ）は上記アクチュエータを駆動させるための駆動ＩＣ４をＦＰＣ５とともにアクチェータに実装した場合の断面図、図３（ｂ）は、図３（ａ）中のＦＰＣ５の平面図で、駆動ＩＣ４の制御信号入力端子４ｂは、アクチュエータの内部共通電極３ａしか配設されていない非実行部Ｂ上で、ＦＰＣ５の入力信号パット５ａと半田等で電気的にパターン接合され、一方、駆動ＩＣ４の出力信号端子４ａは、前記複数Ｃｈのアクチュエータと同じ密度（ピッチ）に配列され、各ＰＺＴ１の外部選択電極２ｂと光硬化性樹脂６で電気的に接合されている。なお、駆動ＩＣ４への制御信号はＦＰＣ５を介してＦＰＣ５の入力信号パット５ａから入力されている。また、ＦＰＣ５は駆動ＩＣ４の支持部材になっており、また、前記出力信号端子４ａは、半田接合も可能であるが、光硬化性樹脂６を利用した方が熱によるＰＺＴ１への熱ダメージが小さく、脱分極や容量低下等を起こさない。

【００１５】図４（ａ）はアクチュエータに駆動ＩＣ４を実装した他の実施例の断面図、図４（ｂ）は、図４（ａ）中のＦＰＣ５の平面図で、ＦＰＣ５はあらかじめ

駆動ＩＣ４の接合用のパット５ａ，５ｃ及び、外部電極２ｂ，３ｂとの接合用のパターン５ｂ，５ｄ（電気回路）をパターニングし、このＦＰＣ５に駆動ＩＣ４を接合し、この駆動ＩＣ４を接合したＦＰＣ５をアクチュエータの非実行部Ｂに接合している。

【００１６】メインボードから出た制御信号はＦＰＣ５を介して入力信号パッド５ａに接合されている駆動ＩＣ４の制御信号入力端子４ｂから駆動ＩＣ４に入り、駆動ＩＣ４の出力は出力信号端子４ａ、出力信号パット５ｃ、選択電極用５ｄ、外部選択電極２ｂと伝わる。ＦＰＣ５のパターン５ｂ，５ｄのＰＺＴ１接合面側には半田メッキが施されており、熱圧接によってＦＰＣ５とＰＺＴ１は半田接合されている。このとき、共通電極側のパターンにより分断された外部共通電極３ｂを電気的に導通させるが、半田が溝内に入り込んでも、内部選択電極２ａは半田が入り込んだ場所には内層されていないので、電極間のショートは起こらない。

【００１７】図５（ａ）は前記アクチュエータに駆動ＩＣ４を実装した更に他の実施例を示す断面図、図５（ｂ）は、図５（ａ）中の支持部材７の平面図で、ＰＺＴ１の外部電極２ｂ，３ｂの配置してある非実行部Ｂ上にガラエポ基板（支持部材）７を配置し、このガラエポ基板７上に駆動ＩＣ４及びＦＰＣ５を接合している。

【００１８】このガラエポ基板（支持部材）７には、一面に駆動ＩＣ４や、ＦＰＣ５等を配接するための電気回路、他の方の面に分断された外部共通電極３ｂに接するベタパターン７ｅが設けてあり、更に、このベタパターン７ｅと反対側の電気回路をつなぐスルーホール８を有している。

【００１９】駆動ＩＣ４はガラエポ基板７上の入出力信号パット７ａ，７ｂに半田接合によって接合される。制御信号はＦＰＣ５を介して、基板７上の入力信号パット７ａに結線されている制御信号入力端子４ｂに入力される。前記ＦＰＣ５とガラエポ基板７との接合は熱圧接による半田接合または異方性導電膜による接合などを利用しても良いし、コネクタによる機械的圧接でも良い。また、溝加工時に分断されたＰＺＴ１の外部共通電極３ｂは、基板裏面のベタパターン７ｅと導電性接合部材で電気的に接合され、基板スルーホール８を介して、ＦＰＣ５及び、共通電極用パット７ｆ、駆動ＩＣ４とを結線している。

【００２０】駆動ＩＣ４からの出力信号は、出力信号端子４ａ，出力信号パット７ｂ，ワイヤボンディング用パット７ｄ，ワイヤボンディング９を通って、ＰＺＴ１の外部選択電極２ｂに出力される。また、前記ワイヤボンディング９の代わりにＦＰＣ５を用いて、基板７上の出力信号とＰＺＴ１上の選択電極２ｂを結線しても良い。ワイヤボンディング９をする際は、基板７を固定するために、絶縁性の接着部材１０でＰＺＴ１と接合した方が良い。

【００２１】図４および図５に示した実施例においては、駆動ＩＣ４をＰＺＴ１の非実行部Ｂ上に配置したＦＰＣ５またはガラエポ基板７上に配置するようにした例を示したが、このようにした方が、非実行部Ｂ上に直接駆動ＩＣを配置する場合より、駆動による振動の影響が無く、信頼性が高くなる。図４、図５に示す実施例において、駆動ＩＣ４とＦＰＣ５またはガラエポ基板７との接合には、半田接合に限らず、光硬化性樹脂の収縮による機械的圧接やワイヤボンディングが利用できる。また、前記ＰＺＴ１は必要に応じてセラミック、ガラスなどの基板上に支持する方が作業性が向上する。更に、図５では支持部材にガラエポ基板を使ったが、これに限ることはなく、他の樹脂等でもよい。

【００２２】図６は駆動ＩＣ４の一部を補助部材１１を使用して保持するようにした場合の一実施例を示す図で（ＰＺＴ外部電極とＩＣの結線等は図示せず）、この実施例によると、ＰＺＴ１の非実行部が縮小化されるので、ＰＺＴ１の小形化、低コストが図れる。補助部材１１としては、樹脂、ガラス、セラミック等を用いることができる。

【００２３】図７は本発明が適用されたインクジェットヘッドの断面図で、この実施例は、ＰＺＴ１のｄ３３方向（厚み方向）の変位を利用して流路１２の容積を変化させ、インク液をノズル１３より吐出するようにした場合のインクジェットヘッドの概略構造図であるが、本発明はこれに限らず、ｄ３１方向変位またはバイモルフ変位を利用したヘッドにも適応できる。

【００２４】

【発明の効果】以上の説明から明らかなように本発明には以下のような効果がある。

（１）請求項１に対応する効果：共通電極部材がＰＺＴの実行部から離れているので、分断された各共通電極の溝間内部に導電性部材が、例えば、半田等が入り込んでも選択電極とショートしない。よって、インクジェットヘッドの歩留り率がよくなる。

（２）請求項２に対応する効果：ＰＺＴの非実行部上に駆動ＩＣを設けているので、ヘッドユニット全体の小型化、低コストになる。

（３）請求項３に対応する効果：駆動ＩＣの保持の一部が補助部材によって行われるので、ＰＺＴの非実行部分を縮小することができ、低コスト化が図れる。

（４）請求項４に対応する効果：請求項２の効果に加え、駆動ＩＣが支持部材に接合されているので、ＰＺＴの非実行部上に駆動ＩＣを配置する際に取り扱いが容易になり、組立性が向上し、振動に対する信頼性も向上する。

（５）請求項５に対応する効果：請求項４の効果に加え、駆動ＩＣの支持部材に回路がパターニングされているので、駆動ＩＣとＰＺＴの外部電極との電気的接合が支持部材を介して一括してでき組立性が向上する。

（６）請求項６に対応する効果：請求項４又は５の効果に加え、駆動ＩＣの支持部材にスルーホールを有するので、ＰＺＴの外部電極接合面と駆動ＩＣ接合面とを電気的に導通させることができ、更には、接合によってはみ出した半田の逃げしろになり、はみ出しによる他部材とのショートを防止する。

（７）請求項７に対応する効果：請求項２乃至６のうち１項の効果に加え、ＰＺＴの外部電極と駆動ＩＣが光硬化樹脂で接合されているので、熱によるＰＺＴの劣化（脱分極、容量低下など）が無くなり、歩留り率がよくなる。

【図面の簡単な説明】

【図１】　本発明の実施例に使う積層型圧電素子を説明するための図である。

【図２】　図１の積層型圧電素子に外部電極を配置した図である。

【図３】　光硬化性樹脂を使い駆動ＩＣをアクチュエータの非実行部上接合した図である。

【図４】　電気回路を設けたＦＰＣ上に駆動ＩＣを設け、該ＦＰＣをアクチュエータに接合した図である。

【図５】　スルーホールを設けた支持部材を介して、アクチュエータに駆動ＩＣとＦＰＣを接合した図である。

【図６】　補助部材を用いて駆動ＩＣをアクチュエータに接合した図である。

【図７】　ｄ３３変位の圧電素子を使ったインクジェットヘッドの概略断面図である。

【図８】　従来のインクジェット記録ヘッドの他の例を説明する平面図である。

【図９】　従来のインクジェット記録ヘッドの製造工程の一部を示す斜視図である。

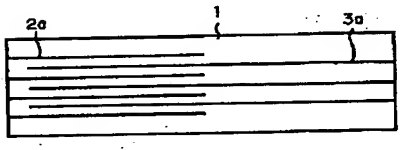
【図１０】　図９に示した工程の後工程の一部を示す斜視図である。

【図１１】　図９，図１０に示したインクジェット記録ヘッドの断面図（図１０のＡ－Ａ線断面図）である。

【符号の説明】

１…積層型圧電素子（ＰＺＴ），２…選択電極、３…共通電極、４…駆動ＩＣ、５…ＦＰＣ、６…光硬化性樹脂、７…支持部材、８…スルーホール、９…ワイヤボンディング、１０…絶縁性接着材、１１…補助部材、１２…流路、１３…ノズル、２０…上部電極、２１…圧電素子、２２…ハンダ付け部、２３…ドット電極、２４…共通電極、２５…本体、２６…下部電極、３０…基板、３１ａ～３１ｃ…電極、３２…圧電素子、３３…スリット、３４…駆動ＩＣ。

【図１】



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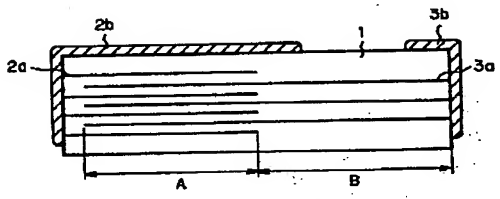

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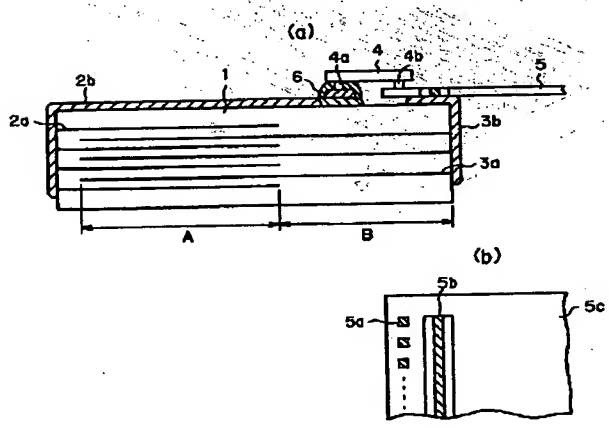

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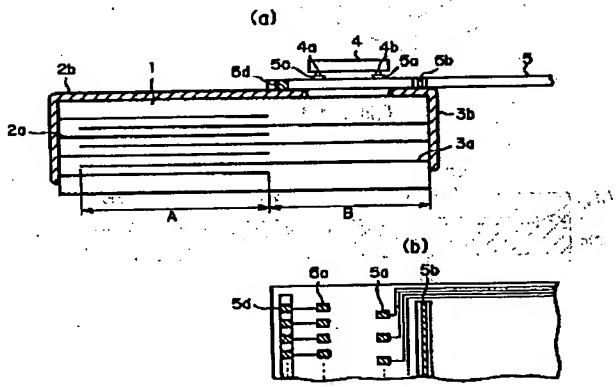

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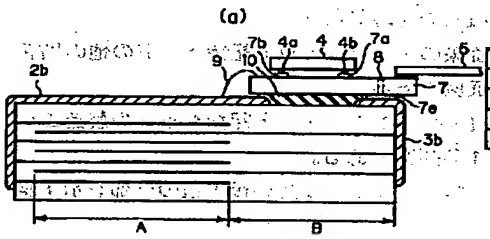

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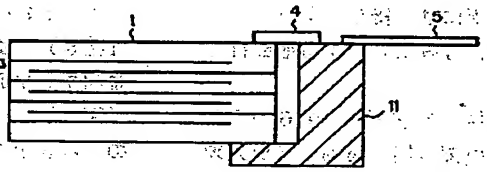

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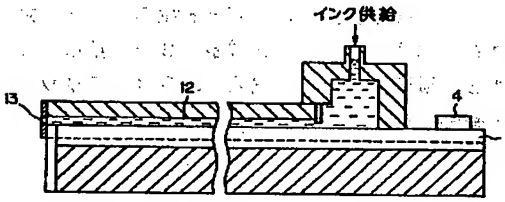

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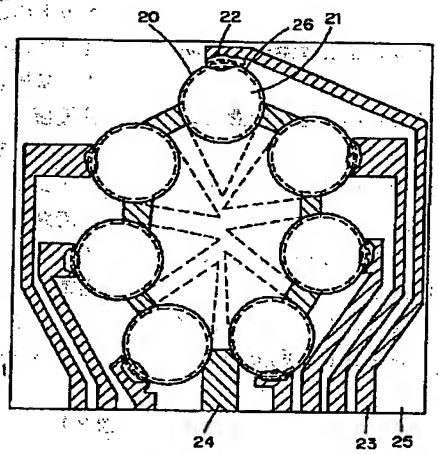

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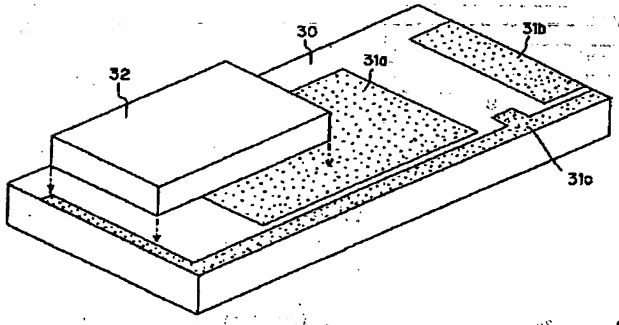

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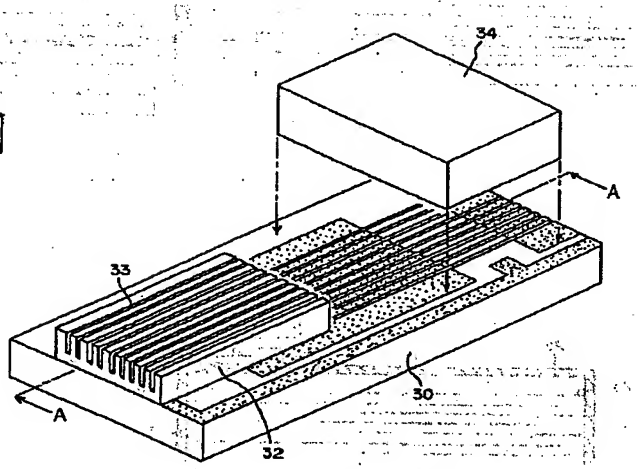
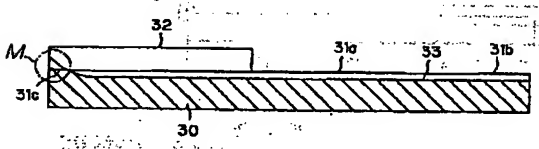


【図１１】



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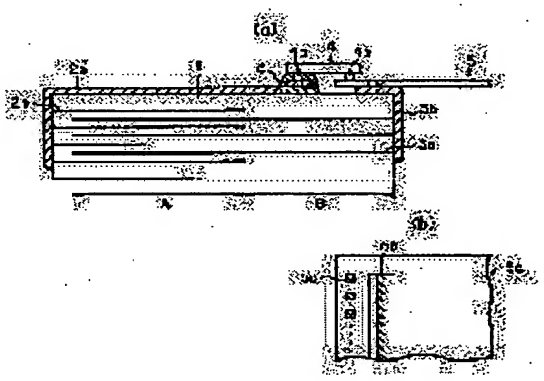
(54) INK JET HEAD

(57)Abstract:
PURPOSE: To simply and surely perform an electrical connection with each divided piezoelectric element and improve the productivity in an ink jet head with an actuator wherein the piezoelectric elements divided by a specified pitch are used.
CONSTITUTION: A driving IC 4 is placed on the non-executing part B of an actuator and an output signal terminal 4a of the driving IC 4 is arranged by the same pitch as a plurality of the front and rear actuators ch and is electrically bonded with an outer electrode 2b of each PZT 1 with a photocurable resin 6.



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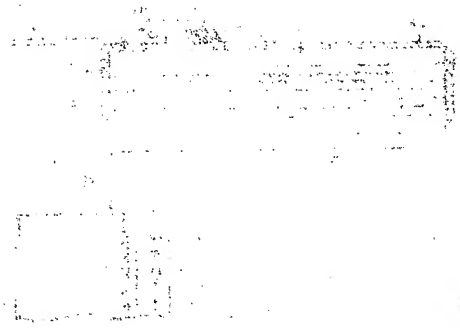

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The ink jet head characterized by having the activation section and the non-performing section, consisting of two or more laminating mold piezoelectric devices divided by one train in the predetermined pitch, having the actuator with which the external selection electrode member and the external common electrode member have been arranged at this a part of laminating mold piezoelectric device [at least], and for said external common electrode member separating from the activation section of said laminating mold piezoelectric device, and arranging it.
[Claim 2] The ink jet head characterized by having the activation section and the non-performing section, consisting of two or more laminating mold piezoelectric devices divided by one train in the predetermined pitch, having the actuator with which the external selection electrode member and the external common electrode member have been arranged at this a part of laminating mold piezoelectric device [at least], and having the drive IC for making said laminating mold piezoelectric device drive alternatively on the non-performing section of said laminating mold piezoelectric device.
[Claim 3] Have the activation section and the non-performing section and it consists of two or more laminating mold piezoelectric devices divided by one train in the predetermined pitch. It has the actuator with which the external selection electrode member and the external common electrode member have been arranged at this a part of laminating mold piezoelectric device [at least]. The ink jet head to which a part of drive [at least] IC for making said laminating mold piezoelectric device drive alternatively is characterized by being arranged on said laminating mold piezoelectric device and an auxiliary member.
[Claim 4] Said drive IC is an ink jet head according to claim 2 characterized by joining at least the part to supporter material.
[Claim 5] It is the ink jet head according to claim 4 to which said drive IC is characterized by joining the part to the external electrode member of said laminating mold piezoelectric device electrically through said supporter material at least by carrying out patterning of the electrical circuit to said supporter material.
[Claim 6] Said supporter material is an ink jet head according to claim 4 or 5 characterized by having a through hole into the part electrically joined to the external electrode member of said laminating mold piezoelectric device.
[Claim 7] An ink jet head given in claim 2 to which the external electrode member of said laminating mold piezoelectric device is characterized by being electrically joined to other members by the photo-setting resin thru/or any 1 term of 6.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to an ink jet head and the ink jet head of the so-called multi-nozzle type which has many ink jet nozzles in a detail more.
[0002]
[Description of the Prior Art] Drawing 8 is drawing showing the example of junction of the piezoelectric-device electrode of the ink jet head of the conventional multi-nozzle type, and a signal-line electrode (JP,55-86765,A). They are the up electrode with which 20 were arranged in one piezoelectric-device 21 side, and the lower electrode with which 26 was arranged in the another side side of a piezoelectric device 21 among drawing. It is made to join to the common electrode 24 of the diaphragm which formed electrodes 20 and 26 up and down, connected the up electrode 20 with the selection electrode 23 in the soldering section 22, and arranged the lower electrode 26 on the pressure room of a piezoelectric device 21 like illustration.
[0003] Moreover, these people proposed about the ink jet recording device made into the electrical installation which became independent of a piezoelectric device to the exterior by carrying out pattern separation of the electrode pattern previously arranged on a substrate at slit processing and coincidence of each piezoelectric device (JP,3-73347,A).
[0004] A perspective view for drawing 9 and drawing 10 to explain an example of the ink jet head which these people proposed previously, and a substrate 30 usually consist of silicon, a ceramic, glass, resin, etc., an electrode usually consists of electrode 31a for electrode connection of the piezoelectric-device drive IC, electrode 31b for external lead-wire connection, and electrode 31c for grand electrodes, and patterning of these electrodes is carried out on the substrate 30. Thus, the electrode has joined the piezoelectric device 32 with means, such as adhesion, by positioning of an outline on the substrate 30 by which patterning was carried out. Next, a slit 33 is processed into this piezoelectric device 32 by cutting etc. Eight [// about] integration of mm is attained by processing the width of 30-40 micrometers and a piezoelectric device 32 for the width of a slit 33 by about 80-90 micrometers. This is processible enough with the usual dicing saw etc.
[0005] Drawing 11 is the A-A line sectional view of drawing 10 , this drawing is drawing after carrying out like **** and forming a slit 33, and an electrode pattern also dissociates and becomes independent of a piezoelectric device 32 being substantially separated by this slit processing at coincidence. That is, a substrate 30 will also be processed into a piezoelectric device 32 and coincidence in part at this time. Moreover, the front face (the M section of drawing 11) of a substrate 30 is made not to process it in order to make it not separate grand electrode 31c. By next, drive IC 34 (the electrode is arranged according to the pitch of the pattern of the separated electrode) is attached by a chip flow etc. By choosing the quality of the material of a substrate 30 suitably, it also becomes possible to fully radiate heat in drive IC 34.
[0006]
[Problem(s) to be Solved by the Invention] However, with the conventional technique shown in drawing 8 , when integration of a nozzle progresses by the improvement in image quality, or improvement in the speed of printing speed and a piezoelectric device is increased, arrangement of the selection electrode 23 arranged on the head body 25 becomes complicated, a process takes time amount, and an inter-electrode distance and a possibility of short-circuiting in short **** come out.
[0007] Moreover, although inter-electrode short-circuit can be prevented, since according to the technique which these people who showed drawing 9 thru/or drawing 11 proposed previously slit processing is interrupted in the front face of a piezoelectric device so that the grand electrode of each piezoelectric device may not be separated and it is considering as the common electrode, a possibility that a piezoelectric device may be damaged is during slit processing, and the yield is bad.
[0008] This invention was made in view of the actual condition like ****, it prevents short-circuit in the electrical installation from the actuator especially accumulated by high density to the exterior, and further, it raises workability and assembly nature, and it aims at offering the ink jet head which raised dependability while it aims at reduction of costs.
[0009]
[Means for Solving the Problem] In order that this invention may solve the above-mentioned technical problem, it has (1) activation section and the non-performing section. Consist of two or more laminating mold piezoelectric devices divided by one train in the predetermined pitch, and it has the actuator with which the external selection electrode member and the external common electrode member have been arranged at this a part of laminating mold piezoelectric device [at least]. said external common electrode member separates from the activation section of said laminating mold piezoelectric device, and is arranged — or (2) Have the activation section and the non-performing section and it consists of two or more laminating mold piezoelectric devices divided by one train in the predetermined pitch. It has the actuator with which the external selection electrode member and the external common electrode member have been arranged at this a part of laminating mold piezoelectric device [at least], and has the drive IC for making said laminating mold piezoelectric device drive alternatively on the non-performing section of said laminating mold piezoelectric device, Or have (3) activation sections and the non-performing section and it consists of two or more laminating mold piezoelectric devices divided by one train in the predetermined pitch. It has the actuator with which the external selection electrode member and the external common electrode member have been arranged at this a part of laminating mold piezoelectric device [at least]. a part of drive [at least] IC for making said laminating mold piezoelectric device drive alternatively is arranged on said laminating mold piezoelectric device and an auxiliary member — further (4) — as for said drive IC, at least the part is joined to supporter material — further (5) Patterning of the electrical circuit is carried out to said supporter material, and, as for said drive IC, the part is electrically joined to the external electrode member of said laminating mold piezoelectric device through said supporter material at least, (6) — said supporter material has a through hole into the part

electrically joined to the external electrode member of said laminating mold piezoelectric device — further [furthermore,] (7) By the photo-setting resin, the external electrode member of said laminating mold piezoelectric device is characterized by being electrically joined to other members.
[0010]
[Function] The effect in an external common electrode member makes it hard to attain to the activation section by separating an external common electrode member from the activation section of a laminating mold piezoelectric device, and arranging it. Moreover, Drive IC is allotted on the non-performing section of a laminating mold piezoelectric device, and an ink jet is used as a compact. Moreover, a laminating mold piezoelectric device is made small by arranging the auxiliary member supporting Drive IC. Moreover, vibration from the activation section of a piezoelectric device is made hard to tell Drive IC by relieving the handling at the time of joining on a piezoelectric device, and making it a direct drive IC not touch a piezoelectric device by making it join on a piezoelectric device, after attaching Drive IC in supporter material. Furthermore, putter NINKU of the electrical circuit is carried out at supporter material, and it can be made to carry out with a piezoelectric device package junction. Furthermore, solder is electrically missed for between the front flesh sides of supporter material to this through hole with rope **** by establishing a through hole in supporter material. Furthermore, degradation of the piezoelectric device by heat is prevented by using a photo setting resin for joints, such as an electrode.
[0011]
[Example] Drawing 1 is drawing showing the cross section of the laminating mold piezoelectric device 1 which comes to carry out two or more laminatings of piezoelectric material and the electrode material by turns, and explains junction of the electrode at the time of forming hereafter the actuator which divided and arranged this laminating mold piezoelectric device (henceforth, PZT) 1 covering the overall length in one train in the predetermined pitch, and an ejection method.
[0012] Drawing 2 is a sectional view at the time of arranging external selection electrode 2b and external common electrode 3b to PZT1, and in this drawing, external energization pole 3b separates from the activation section A of PZT1 with which internal selection electrode 2a and internal common electrode 3a have lapped, and is arranged. In addition, external electrode 2b and 3b were formed with nickel, AgPd, Au, solder, etc., and it has flowed through them electrically with each internal electrodes 2a and 3a by both sides of PZT1.
[0013] Next, external electrode 2b and 3b every recessing is performed for PZT1 with a dicing saw etc. in a predetermined pitch, and the actuator which has two or more Ch(s) (channel) is formed. Under the present circumstances, since external common electrode 3b is divided by recessing by each Ch like external selection electrode 2b, it is necessary to take a flow electrically. Like explanation of above-mentioned drawing 2 , if external common electrode 3b is fully separated from the activation section A of PZT1, although the conductive members (solder, silver paste, etc.) for taking the flow of external common electrode 3b enter in an internal electrode, there will be no fear of short-circuiting with internal selection electrode 2a.
[0014] The sectional view at the time of mounting the drive IC 4 for making the above-mentioned actuator drive in AKUCHIEETA with FPC5 and drawing 3 (b) drawing 3 (a) With the top view of FPC5 in drawing 3 (a), control signal input terminal 4b of drive IC 4 On the non-performing section B in which only internal common electrode 3a of an actuator is arranged Pattern junction is electrically carried out with input signal putt 5a of FPC5, solder, etc., and on the other hand, output-signal terminal 4a of drive IC 4 is arranged by the same consistency (pitch) as the actuator of said plurality Ch, and is electrically joined by each external selection electrode 2b of PZT1, and the photo-setting resin 6. In addition, the control signal to drive IC 4 is inputted from input signal putt 5a of FPC5 through FPC5. Moreover, FPC5 is the supporter material of drive IC 4, and although a soldered joint is also possible, said output signal terminal 4a has a small heat damage to PZT1 according [the direction using a photo-setting resin 6] to heat, and causes neither depolarization nor a capacity fall.
[0015] The sectional view of other examples which mounted the drive IC 4 in the actuator, and drawing 4 (b) drawing 4 (a) the top view of FPC5 in drawing 4 (a) — the putt 5a and 5c beforehand for junction of drive IC 4 in FPC5 — and FPC5 which carried out patterning of the patterns 5b and 5d (electrical circuit) for junction to external electrode 2b and 3b, joined the drive IC 4 to this FPC5, and joined this drive IC 4 is joined to the non-performing section B of an actuator.
[0016] The control signal which came out of the main board goes into drive IC 4 from control signal input terminal 4b of the drive IC 4 joined to input signal pad 5a through FPC5, and the output of drive IC 4 is transmitted with output signal terminal 4a, output signal Pat 5c, 5d for selection electrodes, and external selection electrode 2b. Solder plating is performed to the PZT1 patterns [of FPC5 / 5b and 5d] plane-of-composition side, and FPC5 and PZT1 are joined by solder by the heat pressure welding. Although it is made to flow through external common electrode 3b divided with the pattern by the side of a common electrode electrically at this time, although entered in a solder fang furrow, since the inner layer of the internal selection electrode 2a is not carried out to the location which solder entered, inter-electrode short-circuit does not take place.
[0017] Drawing 5 (a) has arranged the GARAEPO substrate (supporter material) 7 on the non-performing section B which the sectional view and drawing 5 (b) which show the example of further others which mounted the drive IC 4 to said actuator are the top view of the supporter material 7 in drawing 5 (a), and arranges external electrode 2b of PZT1, and 3b, and drives IC4 and FPC5 are joined on this GARAEPO substrate 7.
[0018] Solid pattern 7e which touches external common electrode 3b divided by the electrical circuit for ****(ing) drive IC 4 and FPC5 grade on the whole surface and the field in the direction of others is prepared in this GARAEPO substrate (supporter material) 7, and it has further the through hole 8 which connects the electrical circuit of this solid pattern 7e and the opposite side.
[0019] Drive IC 4 is joined to the I/O signal putt 7a and 7b on the GARAEPO substrate 7 by soldered joint. A control signal is inputted into control signal input terminal 4b by which connection is carried out to input signal putt 7a on a substrate 7 through FPC5. The junction to said FPC5 and GARAEPO substrate 7 may use the soldered joint by the heat pressure welding, or junction by the anisotropy electric conduction film, and the mechanical pressure welding by the connector may be used for it. Moreover, it is electrically joined to solid pattern 7e on the rear face of a substrate by conductive joint material, and external common electrode 3b of PZT1 divided at the time of recessing is connecting FPC5 and putt 7f for common electrodes, and drive IC 4 through the substrate through hole 8.
[0020] The output signal from drive IC 4 passes along output-signal terminal 4a, output-signal putt 7b, and putt 7d for wirebonding, and wirebonding 9, and is outputted to external selection electrode 2b of PZT1. Moreover, FPC5 may be used instead of said wirebonding 9, and selection electrode 2b on the output signal on a substrate 7 and PZT1 may be connected. It is better to join to PZT1 by the insulating jointing material 10, since a substrate 7 is fixed in case wirebonding 9 is carried out.
[0021] In the example shown in drawing 4 and drawing 5 , although the example arranged on FPC5 which has arranged the drive IC 4 on the non-performing section B of PZT1, or the GARAEPO substrate 7 was shown, from the case where the direction

carried out in this way arranges a direct drive IC on the non-performing section B, there is no effect of vibration by drive, and dependability becomes high. In the example shown in drawing 4 and drawing 5 , the mechanical pressure welding and wirebonding by contraction of not only a soldered joint but a photo-setting resin can be used for junction to drives IC4 and FPC5 or the GARAEPO substrate 7. Moreover, as for said PZT1, workability of direction supported on substrates, such as a ceramic and glass, if needed improves. Furthermore, although the GARAEPO substrate was used for supporter material in drawing 5 , it may not restrict to this and other resin etc. is sufficient.

[0022] Since the non-performing section of PZT1 is contraction-ized in drawing showing one example at the time of holding a part of drive IC 4 using the auxiliary member 11 according to (the connection of a PZT external electrode and IC etc. is not illustrated), and this example, drawing 6 can plan the miniaturization of PZT1, and low cost. Resin, glass, a ceramic, etc. can be used as an auxiliary member 11.

[0023] although drawing 7 is the sectional view of an ink jet head where this invention was applied and this example is outline structural drawing of the ink jet head at the time of changing the volume of passage 12 using the variation rate of 1dPZT33 direction (the thickness direction), and being made to carry out the regurgitation of the liquid ink from a nozzle 13 — this invention — d[not only this but]31 direction — a variation rate or bimorph — it can be adapted also for the head using a variation rate.

[0024]

[Effect of the Invention] There is the following effectiveness in this invention so that clearly from the above explanation.

(1) Effectiveness corresponding to claim 1 : since the common electrode member is separated from the activation section of PZT, a conductive member does not short-circuit with a selection electrode inside between [of each divided common electrode] slots, although solder etc. enters. Therefore, the rate of the yield of an ink jet head becomes good.

(2) Effectiveness corresponding to claim 2 :P Since Drive IC is formed on the non-performing section of ZT, it becomes the miniaturization of the whole head unit, and low cost.

(3) Effectiveness corresponding to claim 3 : since a part of maintenance of Drive IC is performed by the auxiliary member, the non-performing part of PZT can be reduced and low cost-ization can be attained.

(4) Effectiveness corresponding to claim 4 : since Drive IC is joined to supporter material in addition to the effectiveness of claim 2, in case Drive IC is arranged on the non-performing section of PZT, handling becomes easy, assembly nature improves, and the dependability over vibration also improves.

(5) Effectiveness corresponding to claim 5 : since patterning of the circuit is carried out to the supporter material of Drive IC in addition to the effectiveness of claim 4, electric junction to the external electrode of Drives IC and PZT can be collectively performed through supporter material, and assembly nature improves.

(6) since it has a through hole in the supporter material Of Drive IC in addition to effectiveness:claim 4 or the effectiveness of 5 corresponding to claim 6, make it flow through the external electrode plane of composition and drive IC plane of composition of PZT electrically, and the solder which it began to see depending on junction should carry out recess further — come to be alike, and it is based on a flash, and also prevent short-circuit with a member.

(7) Effectiveness corresponding to claim 7 : since Drive IC is joined to the external electrode of PZT by photo-curing resin claim 2 thru/or among 6 in addition to the effectiveness of the 1st term, degradation (depolarization, capacity fall, etc.) of PZT by heat is lost, and the rate of the yield becomes good.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing for explaining the laminating mold piezoelectric device used for the example of this invention.
[Drawing 2] It is drawing which has arranged the external electrode to the laminating mold piezoelectric device of drawing 1 .
[Drawing 3] It is drawing which joined Drive IC on the non-performing section of an actuator using the photo-setting resin.
[Drawing 4] Drive IC is formed on FPC which prepared the electrical circuit, and it is this drawing that joined FPC to the actuator.
[Drawing 5] It is drawing which joined Drives IC and FPC to the actuator through the supporter material which prepared the through hole.
[Drawing 6] It is drawing which joined Drive IC to the actuator using the auxiliary member.
[Drawing 7] It is the outline sectional view of the ink jet head using the piezoelectric device of d33 variation rate.
[Drawing 8] It is a top view explaining other examples of the conventional ink jet recording head.
[Drawing 9] It is the perspective view showing a part of production process of the conventional ink jet recording head.
[Drawing 10] It is the perspective view showing a part of back process of the process shown in drawing 9 .
[Drawing 11] It is the sectional view (A-A line sectional view of drawing 10) of the ink jet recording head shown in drawing 9 and drawing 10 .
[Description of Notations]
1 [— Drive IC] — A laminating mold piezoelectric device (PZT), 2 — A selection electrode, 3 — A common electrode, 4 5 [— Through hole,] — FPC, 6 — A photo-setting resin, 7 — Supporter material, 8 9 [— Passage,] — Wirebonding, 10 — An insulating binder, 11 — An auxiliary member, 12 13 [— The soldering section, 23 / — A dot electrode, 24 / — A common electrode, 25 / — A body, 26 / — A lower electrode, 30 / — A substrate, 31a-31c / — An electrode, 32 / — A piezoelectric device, 33 / — A slit, 34 / — Drive IC.] — A nozzle, 20 — An up electrode, 21 — A piezoelectric device, 22

[Translation done.]

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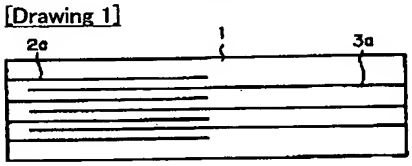
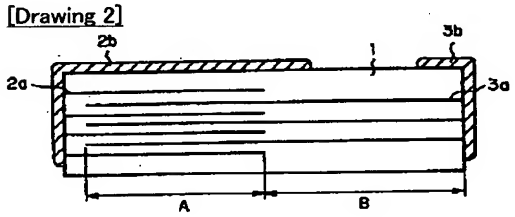
* NOTICES *

DRAWINGS

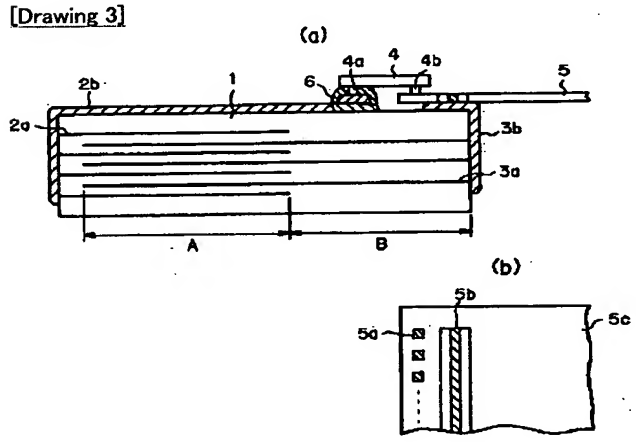
[Drawing 1]



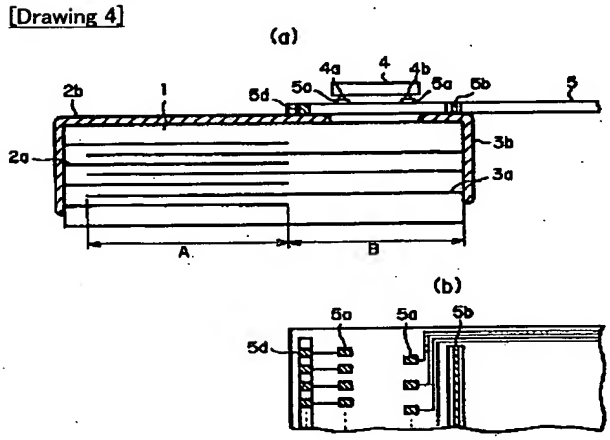
[Drawing 2]



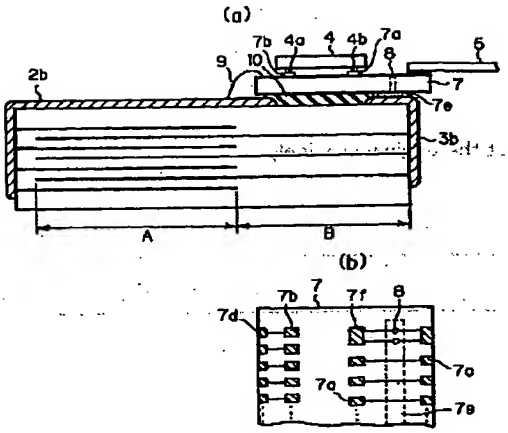
[Drawing 3]



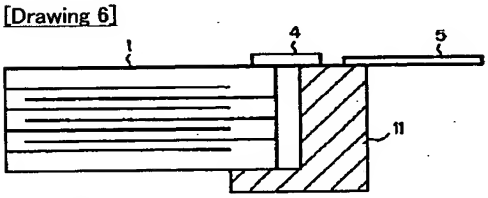
[Drawing 4]



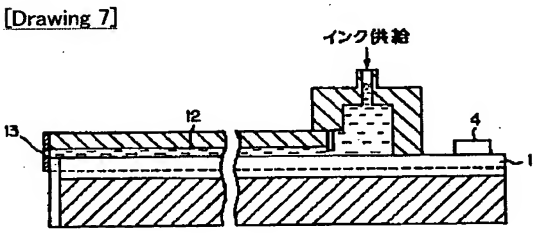
[Drawing 5]



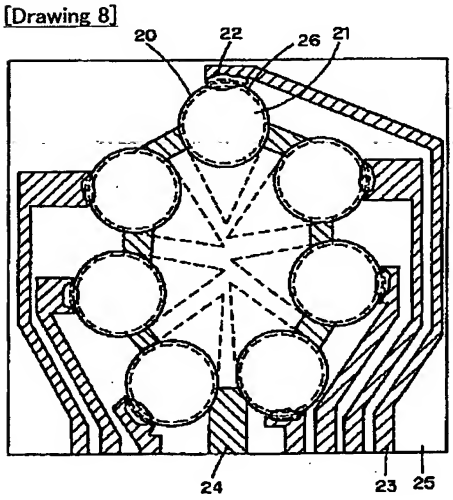
[Drawing 6]



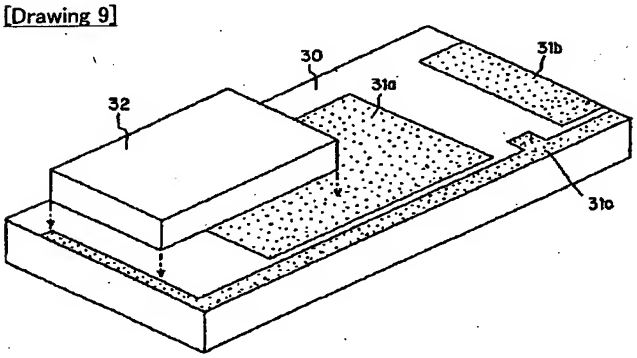
[Drawing 7]



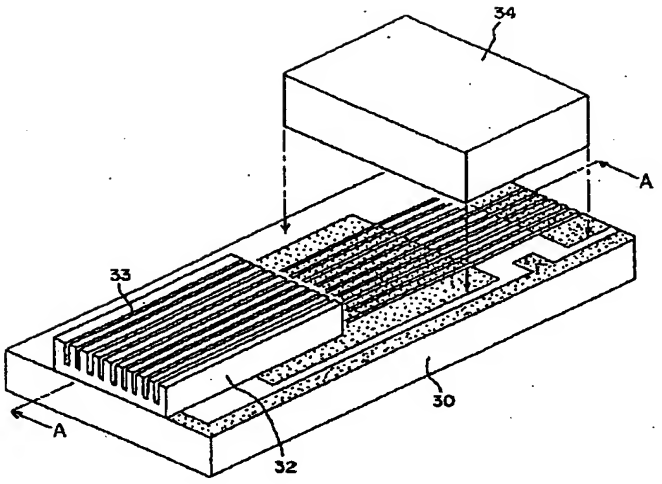
[Drawing 8]



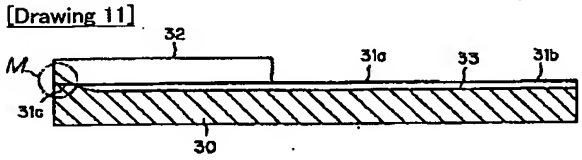
[Drawing 9]



[Drawing 10]



[Drawing 11]



[Translation done.]